WHAT IS CLAIMED IS:

1. A method for operating an optical ring, the optical ring including a plurality of nodes, the method comprising:

propagating a plurality of optical signal pairs over a plurality of wavelength connections between the nodes, wherein each such optical signal pair includes a first signal having a first wavelength λ_a and a second signal having a second wavelength λ_b that differs from λ_a, and wherein at at least one of the plurality of nodes the first signal acts as a transmit signal and the second signal acts as a receive signal; and

redirecting at least one of the optical signal pairs over a protection path in response to a failure in the optical ring, wherein the protection path propagates signals with respect to the at least one of the plurality of nodes without changing the wavelengths of the transmit and receive signals.

2. The method recited in claim 1 wherein at least one of the optical signal pairs comprises a bidirectional signal.

3. The method recited in claim 1 wherein at least one of the optical signal pairs comprises a unidirectional signal.

4. The method recited in claim 1 wherein redirecting at least one of the optical signal pairs over a protection path comprises reversing a propagation direction for each of the first and second signals comprised by the at least one of the optical signal pairs.

5. The method recited in claim 1 wherein each node comprises at least two network subelements, wherein for each node a first of the network subelements is configured to receive the first signal and transmit the second signal, and a second of the network subelements is configured to transmit the first signal and receive the second signal.

6. The method recited in claim 5 wherein each network subelement comprises a wavelength router.

7. The method recited in claim 1 wherein, for each optical signal pair, the first and second wavelengths are selected from a set of N discrete wavelengths ordered sequentially by wavelength from λ_1 to λ_N such that $\lambda_b = \lambda_{a \pm n (\mathrm{mod}\, N)}$, with a common fixed integer value of $n \geq 1$ for all optical signal pairs.

8. The method recited in claim 7 wherein $n \geq 4$.

9. The method recited in claim 1 wherein, for each optical signal pair, the first and second wavelengths are selected from a set of N discrete wavelengths ordered sequentially by wavelength from λ_1 to λ_N and divided into m subsets such that $\lambda_{b(\bmod N/m)} = \lambda_{a \pm n(\bmod N/m)}$, with a common fixed integer value of $n \geq 1$ for all optical signal pairs.

10. The method recited in claim 9 wherein $n \geq 4$.

11. The method recited in claim 1 wherein, for each optical pair, the first and second wavelengths are selected from a set of N discrete wavelengths order sequentially from λ_1 to λ_N and divided into m subsets such that

$$\lambda_b = \begin{cases} \lambda_{a+n \ (\bmod N/2)} & (a \leq N/2) \\ \lambda_{((a-N/2+n) \ (\bmod N/2))+N/2} & (N/2 < a \leq N) \end{cases}$$

with a common fixed integer value of $n \geq 1$ for all optical signal pairs.

12. The method recited in claim 11 wherein $n \geq 4$.

13. The method recited in claim 1 wherein redirecting at least one of the optical signal pairs over a protection path comprises using head-end switching.

14. The method recited in claim 1 wherein the failure comprises a connection failure.

15. The method recited in claim 1 wherein the failure comprises a node failure.

16. An optical ring comprising:

a plurality of nodes, with a network element disposed at each such node;

a plurality of optical wavelength connections between the nodes configured for the propagation of optical signals; and

a controller coupled with the plurality of nodes, wherein the controller is configured to propagate a plurality of optical signal pairs, each such optical signal pair including a first signal having a first wavelength λ_a and a second signal having a second

wavelength λ_b that differs from λ_a, such that at at least one of the plurality of nodes the first signal acts as a transmit signal and the second signal acts as a receive signal, and to respond to a failure in the optical ring by redirecting at least one of the optical signal pairs over a protection path without changing the wavelengths of the transmit and receive signals.

17. The optical ring recited in claim 16 wherein at least one of the optical signal pairs comprises a bidirectional signal.

18. The optical ring recited in claim 16 wherein at least one of the optical signal pairs comprises a unidirectional signal.

19. The optical ring recited in claim 16 wherein redirecting at least one of the optical signal pairs over a protection path comprises reversing a propagation direction for each of the first and second signals comprised by the at least one of the optical signal pairs.

20. The optical ring recited in claim 16 wherein each network element comprises at least two network subelements, wherein the controller is configured such that at each node, a first of the network subelements receives the first signal and transmits the second signal, and a second of the network subelements transmits the first signal and receives the second signal.

21. The optical ring recited in claim 20 wherein each network subelement comprises a wavelength router.

22. The optical ring recited in claim 16 further comprising a manager configured, for each optical signal pair, to select the first and second wavelengths from a set of N discrete wavelengths ordered sequentially by wavelength from λ_1 to λ_N such that $\lambda_b = \lambda_{a \pm n (\mathrm{mod}\, N)}$, with a common fixed integer value of $n \geq 1$ for all optical signal pairs.

23. The optical ring recited in claim 22 wherein $n \geq 4$.

24. The optical ring recited in claim 16 further comprising a manager configured, for each optical signal pair, to select the first and second wavelengths from a set of N discrete wavelengths ordered sequentially by wavelength from λ_1 to λ_N and divided into m subsets such that $\lambda_{b (\mathrm{mod}\, N/m)} = \lambda_{a \pm n (\mathrm{mod}\, N/m)}$, with a common fixed integer value of $n \geq 1$ for all optical signal pairs.

25. The optical ring recited in claim 24 wherein $n \geq 4$.

26. The method recited in claim 16 wherein, for each optical pair, the first and second wavelengths are selected from a set of N discrete wavelengths order sequentially from λ_1 to λ_N and divided into m subsets such that

$$\lambda_b = \begin{cases} \lambda_{a+n \pmod{N/2}} & (a \leq N/2) \\ \lambda_{((a-N/2+n) \pmod{N/2})+N/2} & (N/2 < a \leq N) \end{cases}$$

with a common fixed integer value of $n \geq 1$ for all optical signal pairs.

27. The optical ring recited in claim 26 wherein $n \geq 4$.

28. A system for operating a wavelength division multiplexing network comprising an optical ring of nodes interconnected by a plurality of wavelength connections, the system comprising:

a manager configured to select pairs of wavelengths from a set of N discrete wavelengths ordered sequentially by wavelength from λ_1 to λ_N, the pairs of wavelengths defining a plurality of optical signal pairs comprising a first signal having a first wavelength λ_a and a second signal having a second wavelength λ_b that differs from λ_a; and

a controller coupled with the manager and the optical ring, wherein the controller is configured to propagate at least one of the plurality of optical signal pairs along a normal traffic path within the optical ring such that at at least one of the nodes the first signal acts as a transmit signal and the second signal acts as a receive signal and to redirect the at least one of the optical signal pairs over a protection traffic path in response to a failure in the optical ring without changing the wavelengths of the transmit and receive signals.

29. The system recited in claim 28 wherein the controller is configured to redirect the at least one of the optical signal pairs by reversing a propagation direction for each of the first and second signals comprised by the at least one of the optical signal pairs.

30. The system recited in claim 28 wherein, for each optical signal pair, the manager selects the first and second wavelengths such that $\lambda_b = \lambda_{a \pm n \pmod{N}}$, with a common fixed integer value of $n \geq 1$ for all optical signal pairs.

31. The system recited in claim 28 wherein the manager divides the ordered set of discrete wavelengths into m subsets and, for each optical signal pair, selects the

first and second wavelengths such that $\lambda_{b(\bmod N/m)} = \lambda_{a \pm n(\bmod N/m)}$, with a common fixed integer value of $n \geq 1$ for all optical signal pairs.

32. The system recited in claim 28 wherein the manager divides the ordered set of discrete wavelengths into two subsets and, for each optical signal pair, selects the first and second wavelengths such that

$$\lambda_b = \begin{cases} \lambda_{a+n \ (\bmod N/2)} & (a \leq N/2) \\ \lambda_{((a-N/2+n) \ (\bmod N/2))+N/2} & (N/2 < a \leq N) \end{cases}$$

with a common fixed integer value of $n \geq 1$ for all optical signal pairs.

33. A system for operating a wavelength division multiplexing network comprising an optical ring of nodes interconnected by a plurality of wavelength connections, the system comprising:

means for selecting pairs of wavelengths from a set of N discrete wavelengths ordered sequentially by wavelength from λ_1 to λ_N, the pairs of wavelengths defining a plurality of optical signal pairs comprising a first signal having a first wavelength λ_a and a second signal having a second wavelength λ_b that differs from λ_a;

means for propagating at least one of the plurality of optical signal pairs along a normal traffic path within the optical ring such that at at least one of the nodes the first signal acts as a transmit signal and the second signal acts as a receive signal; and

means for redirecting the at least one of the optical signal pairs over a protection traffic path in response to a failure in the optical ring without changing the wavelengths of the transmit and receive signals.

34. The system recited in claim 28 wherein the means for redirecting is configured to reverse a propagation direction for each of the first and second signals comprised by the at least one of the optical signal pairs.